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Vol. 71 No. 16 Issue No. 4228 313-334

April 18th, 1959

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No. 16 APRIL 18th, 1959 Vol. 71

Registered for Transmission as a Newspaper *Price 2s. post free*

" B " or Border Disease

An Undescribed Disease of Sheep

BY

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AND

I. G. SHAW

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THE purpose of this preliminary report is to draw attention to a disease syndrome of sheep which does not appear to have been described previously in veterinary literature. It occurs in Kerry Hill and Clun Forest lambs in numbers of flocks on both sides of the border between England and Wales in the South Shropshire, North-west Hereford, East Radnor, and South-west Montgomery districts. It is perhaps not surprising that the area in which the disease occurs contains a high proportion of well-bred flocks of these two breeds as this is their original home. The countryside consists of a complex mixture of hill and fertile lowland varying in elevation between 450 feet and 1,000 feet above sea-level and is, in general, a mixed farming area, the sheep forming an important part of the farming enterprise on most farms. It is now, and has been for at least 10 years, common practice to breed from well-grown, young ewes in these flocks. These ewe hoggs (the name used in the district for this class of sheep) are encouraged to take the ram in the first autumn of their lives and are fed, like the ewes, during pregnancy, a diet including a fair proportion of roots, hay, and a certain amount of concentrates. The pregnant ewe hoggs receive a greater proportion of roots over a longer period than the older sheep, while the latter generally receive more concentrates over a longer period.

Incidence

" B " or Border disease has been in existence for at least 10 years and is found in pedigree and non-pedigree but well-bred flocks of both breeds. The incidence, although varying from year to year and from farm to farm, has now assumed substantial proportions and is causing concern amongst flock masters. No attempt has been made to establish the true incidence of " B " disease amongst the flocks in the area in which the disease occurs, but figures relating to a number of flocks about which we have been consulted, or otherwise brought into contact, have been obtained and these are set out in the tables overleaf.

It will be seen from Table I that the condition occurs in both breeds; no evidence exists as to the relative incidence of the disease in either breed and, while the table includes figures from four Clun flocks only, it should be pointed out that the disease has been seen in other Clun flocks.

Table II summarises the data in Table I; both tables show that the disease is very largely confined to the progeny of ewe hoggs although a small number of older ewes give birth to affected lambs. The incidence of the disease varies from farm to farm and from year to year on the same farm, but the general opinion held by the farmers questioned is that it is increasing.

Clinical Signs

The clinical signs in a badly affected lamb, although variable, are very definite and in essentials are the same in both breeds. The birth-coat of affected lambs is unlike that of either a well-bred Kerry or Clun. In each case the amount of hair in the fleece is increased and the wool present is long and curly in comparison with a normal lamb of the same breed. A common feature of the affected Kerry lambs is the presence of black wool and hairs on the back of the neck. A small number of pigmented fibres are some-

TABLE I

NUMBERS OF LAMBS AFFECTED WITH "B" DISEASE BORN TO EWES AND EWE HOGGS IN 1956, 1957 AND 1958

Farm number	Breed	1956				1957				1958			
		Ewes		Ewe hoggs		Ewes		Ewe hoggs		Ewes		Ewe hoggs	
		N.L.	A.L.	N.L.	A.L.	N.L.	A.L.	N.L.	A.L.	N.L.	A.L.	N.L.	A.L.
1	Clun	175	3	45	45	170	—	50	50	225	2	105	2
2	"		No information			460	—	130	30	480	—	120	60
3	"	—	—	65	25	240	—	108	2	240	8	74	20
4	" and Kerry		No information			127	3	28	12	55	25	20	20
5	Kerry	300	—	55	10	299	1	25	75	300	2	60	35
6	"	300	2	40	40	200	3	40	40	300	2	60	35
7	"	208	2	44	5	287	5	34	21	283	7	14	39
8	"	350	—	55	35	342	5	81	30	275	4	25	25
9	"	154	—	20	40	145	—	45	45	147	1	21	19
10	"		No information			75	—	12	23	75	—	50	—
11	"	172	—	60	10	173	—	53	7	169	—	60	12
12	"	206	—	40	20	206	—	7	3	200	—	60	—
13	"	116	—	25	15	116	25	20	20	120	—	42	8
		1,981	7	449	245	2,840	42	635	358	2,869	51	711	275

N.L. = Normal lambs. A.L. = Affected lambs.

TABLE II

	Pregnant ewes	Cases of "B" disease	Pregnant ewe hoggs	Cases of "B" disease
		Per cent.		Per cent.
1956	1,988	7 = 0·3	694	245 = 35
1957	2,882	42 = 1·4	995	358 = 36
1958	2,920	51 = 1·7	986	275 = 28
Totals for 3 years	7,790	100 = 1·2	2,675	878 = 32

times seen in normal Kerry lambs but this feature is not liked by the breeders. The birth-coat of affected Clun lambs contains hair and curly wool; the fleece is very dark brown to black in colour and this pigment may be distributed uniformly throughout the fleece or in patches over the body. In general the afflicted lambs are smaller and the rate of growth is slower than normal; the long bones are small and fine. This is probably the reason why they appear more compact and shorter in the leg than normal lambs of the same age. In a number of lambs the shape of the head is abnormal, being somewhat prominent in the frontal region. In addition to the aberrant birth coats, most affected lambs show some defect of gait, often no more than a slight swaying in locomotion or general weakness becoming evident in their inability to keep up with the remainder of the flock when herded. In a proportion of the lambs the nervous signs are more definite, involving varying degrees of trembling, and an affected lamb may have difficulty in getting on its feet; once on its feet such a lamb trembles violently, particularly towards the posterior part of the body, and the hind legs may, in turn, be jerked upwards and forwards from the ground. A lamb trembling to this degree is unable to progress or to suckle. The worm burden appeared

FIG. 1.—A Kerry ewe and a normal lamb.

FIG. 2.—A Kerry ewe and a lamb affected with "B" disease. Note the general conformation, including the shape of head, and the fleece.

FIG. 3.—A normal Kerry lamb and one affected with "B" disease. Note the difference in general conformation and in the fleeces, and the pigmentation at the back of the neck on the lamb on the left.

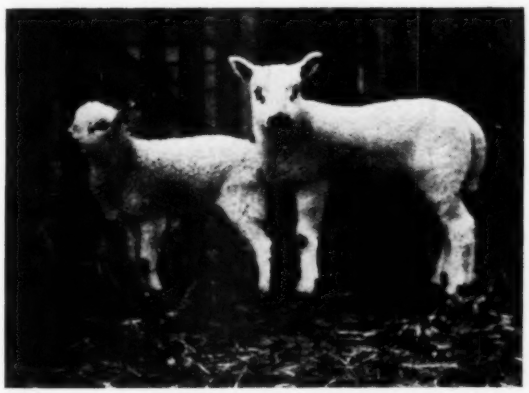

FIG. 4.—A normal lamb and an affected lamb, showing differences in size and in fleece.

to be normal in those examined; cobalt deficiency has not been diagnosed on any of the farms visited and is not a problem in the area.

The photographs illustrate some of the features of "B" disease.

A limited number of clinical pathological examinations have been made, *e.g.* blood samples taken both from normal and affected lambs and from old and young ewes in flocks in which "B" disease has been diagnosed have been examined biochemically and haematologically and no evidence of deficiencies of either Ca, Mg, P, Cu, or haemoglobin has been obtained. The specific gravity of whole blood, plasma, and serum appears to be normal and no abnormalities could be detected in either the volume, numbers, or types of blood cells.

The clinical picture varies from slight changes in the birth coat in an otherwise normal lamb to a minute creature having a grossly abnormal fleece. Some affected lambs show little apart from the character of the birth coat, others tremble in varying degrees up to the point where they cannot walk. Lambs showing varying degrees of the disease between these two extremes may be seen in a badly affected flock.

Mortality

The mortality rate is very high—many of the affected lambs die during the first few weeks of life. Under farm conditions they fail to grow at the same rate as normal lambs, and the difference in size, marked at birth in comparison with the normal, increases as time goes on. Limited observations on weight gains here revealed that 1 affected lamb was only 15 lb. and another only 25 lb. when 6 weeks old while 2 others were 28 lb. and 32 lb. when 6 months old. The effect of weaning is drastic, many which survive to this event die when separated from the ewes, others die when food supplies are reduced in the autumn. The cause of death is unknown.

Post-mortem Findings

The gross *post-mortem* findings are not specific. They vary considerably with the age at which the affected lambs die. Those dying soon after birth show no macroscopic changes; the pneumonia seen in some of those dying later is almost certainly secondary. A common *post-mortem* feature seen in affected lambs dying weeks or months after birth is an absence of fat in the carcase. Dystrophic changes have been seen in the skeletal muscles of a proportion of affected lambs. In general the carcases of affected lambs show no indication of infection and no significant bacteria have been isolated. Liver copper values in the small number of livers examined appear to be normal, varying from 140 to 300 p.p.m. on a dry matter basis.

The most significant finding has been the demonstration of a deficiency of myelin distributed throughout the central nervous system. At the time of writing it is not clear whether this change is in fact a form of demyelination or a deficiency of myelin, the result of a disorder of myelin formation. This deficiency of myelin is present in varying degrees in all parts of the brain and spinal cord, the latter being constantly the most severely affected. The axons of the non-myelinated fibres appear to be intact.

These histopathological changes have, so far, been seen only in ataxic lambs and have been consistently absent in lambs suffering only from the birth-coat changes which are a feature of "B" disease.

Discussion

It is said by flockmasters that lambs suffering from "B" disease, in which the change in the birth-coat is the dominant feature, are virile at birth. They are on their feet and suckling earlier than the normal, bigger lambs with heavier bones, but in spite of this, as already stated, the great majority die. Only a small number reach an age and weight in the autumn such that they are fit for slaughter. Generally speaking, no affected lambs are kept for breeding, but a few have been retained and bred when, it is alleged, they always give birth to affected lambs.

The birth-coat changes in "B" disease appear similar to those described by Dry in 1955 in a series of papers entitled "The Inheritance of Halo-air

Abundance in New Zealand Romney Sheep." No mention is made by Dry of any nervous symptoms associated in any way with the changes in the fleece, but the lambs with increased hair were found to be less likely to withstand adverse environmental conditions than those without this feature (1958). A somewhat similar conclusion was reached by workers on lamb birth-coats at the experimental husbandry farm of the Ministry of Agriculture, Fisheries and Food at Trawscoed in Cardiganshire (Holmes, 1957). Here the mortality before weaning was greater in lambs with kempy and/or hairy birth-coats than in lambs with coats composed mainly of wool. It was found also that the lambs with least hair and more wool (Grade 6) in the fleece at birth grew more rapidly and at weaning were, on the average, 10 lb. heavier than those with the most hair and less wool (Grades 11 and 12). This association of a certain type of birth-coat with reduced viability is more marked in "B" disease.

If the lesion in the central nervous system in "B" disease proves to be demyelination, then it is clear that the condition has much in common with "swayback," but if it should be a form of partial or deficient myelination, then the resemblance to swayback is superficial. As already stated, hypocupraemia is not a feature of "B" disease; in this respect it differs from swayback in which the blood copper levels of affected lambs and their dams are usually depressed.

Insofar as the nervous signs are concerned, "B" disease has some resemblance to the cortical cerebellar atrophy first described by White and Rowlands (1945) in "daft" lambs in the college flock at Bangor. This was believed to be hereditary in origin and has since then been seen by one of us (L. E. H.) in a pedigree flock of Welsh mountain sheep. Stewart (1950), after investigating a number of outbreaks of this disease, suggested that it was essentially a manifestation of mineral malnutrition and was preventable by suitable supplementation of the diet of the pregnant ewes. More recently this condition has been encountered in a number of Suffolk lambs on a farm in Cardiganshire where the sire of the affected lambs was a ram lamb, the son of one of the Suffolk ewes in the flock. Unlike the condition described by White and Rowlands (1945), blindness and deafness are not features of "B" disease and affected lambs are not "daft" as they recognise their mothers and attempt to follow and suckle them after birth.

It is possible that "B" disease may not be a single entity. In the first place, the significant lesion in the central nervous system is present only in the ataxic lambs and is not a feature in those lambs showing the birth-coat changes alone. Terlecki (1958) states that both he and Markson have seen similar changes in histopathological material taken from "trembling" lambs of other breeds in other parts of Great Britain. In none of their cases was any abnormality of the fleece noted. On the other hand, it should be stated that, while changes in the birth-coat with or without nervous signs have been a feature of this investigation, no lamb showing nervous signs only has, as yet, been seen.

The origin of "B" disease is not known. It is clear that it has been recognised for at least 10 years, and it is probable that odd cases were seen by shepherds long before this when they were probably regarded as "weak" lambs dying soon after birth or as undesirable types which were culled wittingly or unwittingly by being left to take their chances of survival in exposed places. The disease is seen on such a variety of farms and soil types that it is unlikely to be a simple deficiency disorder. As already said, on many of the farms where "B" disease has been seen, the ewe hoggs receive, during pregnancy, a much greater proportion of brassicous crops, such as turnips, than the older ewes. The amount of hay and corn fed varies according to the physical condition of the young ewes and upon the weather conditions to which they are exposed. This practice of feeding a large proportion of roots may be of significance as it is becoming clearer that crops of the genus Brassicae, when forming a large part of the diet, may lead to unfortunate results in a number of species of animals. While the evidence available at this stage suggests that "B" disease is hereditary, the difference in incidence between the progeny of ewe hoggs and ewes is so striking even when bred with the same ram that it is possible the disease is not a simple genetic defect but associated in some way with immaturity in the dam. It is stated that ewe hoggs which have given birth to affected lambs when mated with a particular sire are unlikely to do so when bred as shearling ewes with the same ram. Furthermore, ewe hoggs born in the same year as the above but mated for the first time as shearlings with the same ram generally give birth to normal lambs.

The early work of White (1925), Fraser Roberts (1926), and Fraser Roberts and Jenkin (1926) at Bangor showed that Welsh mountain sheep varied in many ways including actual and potential quality and colour of fleece and hair. Clun Forest and Kerry Hill sheep are lineal descendants of the Welsh mountain breed. It is likely that these potential variations have been transmitted to the descendants of the breed and possible that "B" disease is an expression of this genetic make-up under certain conditions of breeding and management, *e.g.* varying degrees of in-breeding in young immature ewes.

Further Work

A breeding experiment involving almost 120 ewe hoggs collected from 8 different farms is being conducted where the effect of early and late mating of young ewes with a number of rams is being compared. In a separate experiment involving a small number of ewes, an effort is being made to observe the effect of in-breeding; it is hoped in this way to concentrate certain genetical factors which may be operating. Finally, it is hoped to collect definite information on the effects of "roots" in the diet of the young pregnant ewe and the part they play in the incidence of the disease.

Acknowledgments.—The authors wish to express their indebtedness to Dr. S. Terlecki, M.R.C.V.S., of the Central Veterinary Laboratory of the Ministry of Agriculture, Fisheries and Food, Weybridge, who

(*Concluded at the foot of col.* 1, *page* 317)

An Osteodystrophy in Siamese Kittens

BY

G. L. B. HENDERSON and E. K. KEYWOOD

Surbiton

SUMMARY.—A condition of osteodystrophy in Siamese kittens is discussed and the symptoms described. The principal pathological changes are found in the bone structure and the thyroid gland. There appear to be two main aetiological factors involved, namely the pre-natal and early post-natal diet, and, secondly, the thyroid adenopathy. The exact aetiology remains obscure but a comparison is drawn between this condition and a similar one produced in kittens maintained on an experimental diet. This reveals an interesting field for further research and it is felt that the clinician can aid the investigation of disease by recording the syndromes observed.

Introduction

THE discussion of this condition is based on the examination of 4 cases which were presented to the writers for treatment during the period January, 1956, to February, 1958. The history and symptoms were similar in each case, and so far this condition has not been experienced in any kittens other than Siamese, and half-bred Siamese. One further case, in an ordinary black-and-white domestic kitten, seen some years ago, was symptomatically similar but the pathology of the condition was not investigated at that time.

History

The condition is usually noticed first at about 8 to 15 weeks of age. The most noticeable symptom at this stage is a posterior paresis which may appear spontaneously or as the result of a slight fall, usually during play. This paresis is generally accompanied by signs of pain or lameness in one fore leg. Occasionally a complete paraplegia occurs with considerable pain and inability to walk at all. In the milder cases, some degree of recovery usually follows and with an increase in muscle tone the kitten is able to walk again. Subsequently, however, the kitten frequently shows evidence of pain when jumping and moves carefully, suggesting some tenderness of the limbs. Typically, a return of the acute symptoms of paresis or paraplegia occurs after a jump (usually from a height of only 2 or 3 feet) or during play.

It was noticed that all the affected kittens were of a particularly docile and quiet disposition and seldom behaved in the boisterous manner characteristic of normal Siamese kittens. In some cases, the kittens were seen to adopt a position of dorsal recumbency when resting.

Symptoms

The symptoms have been similar in all cases so far examined but varying degrees of paralysis have been observed. Typically, the kitten appears to be in good bodily condition and of normal weight and size for its age. In all cases there is complete inability to bear any weight on the hind limbs and there may be a definite paraplegia. Generally, it is possible to elicit some hind pedal reflex, though this is sluggish, and the muscles of the hind limbs and tail are quite flaccid. Pain is usually evident on moving the hind limbs and there is a curvature of the spine in the lumbo-sacral region (Fig. 1). An abdominal distension is usually present and in most cases the kitten is incontinent.

Other symptoms depend upon the duration of the condition but may include pressure sores on the bony prominences and frequently a cystitis is found to be present. The temperature is normal or slightly subnormal and the respiration rate is generally somewhat accelerated.

Urine analysis at this stage shows the typical abnormalities of cystitis or urine retention, *i.e.* a trace of albumen, the presence of blood, and a somewhat alkaline reaction.

" B " or Border Disease—*Concluded.*

carried out the histological examinations and described the lesions present in the central nervous system of the ataxic lambs. The authors thank Mr. P. L. Scudamore, District Officer, Ministry of Agriculture, Fisheries and Food, for bringing this condition to their notice. The authors also wish to thank Messrs. C. T. Carter and J. E. Myatt who took the photographs. Finally, the Biochemistry Department at the Central Veterinary Laboratory, Weybridge, is thanked for the biochemical examinations carried out.

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Addendum

Since this article went to press, Markson *et al.* have reported a nervous disorder of lambs which they have called " hypomyelinogenesis congenita." The symptoms and the lesion in the central nervous system resemble those in the lambs showing nervous symptoms seen by us in lambs affected with " B " disease. These authors do not mention the state of fleece of affected lambs.

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X-ray and *Post-mortem* Examination

X-ray examination showed a generalised loss of calcium from the skeleton. All the bones examined showed rarefaction and osteoporosis. The scapulae were misshapen and paper-thin. The pelvis could easily be cut with scissors. The cortical bone of the limb bones was abnormally thin and fragile. In some cases, the sacral vertebrae were displaced.

In almost all cases examined, the presence of one or more fractures of the limb bones was revealed. These fractures varied from impacted recent fractures to partially healed long-standing fractures (Figs. 2 and 3). Such fractured limb bones would account for the pain observed in walking. The motor paresis and flaccidity was almost certainly due to damage to the spinal cord or cauda equina.

Histopathology

Histological examination confirmed the lack of calcium throughout the skeleton. The changes observed were typical of an osteo-dystrophia fibrosa.

There were also found to be significant changes in the histology of the thyroid gland. The follicles were found to be small and convoluted with relatively high epithelium and lack of stainable colloid. These changes are almost identical to those found in a case of classical diffuse parenchymatous goitre and strongly suggest hyperactivity of the thyroid (Figs. 4 and 5).

This appearance of thyroid hyperactivity would lead one to expect a degree of hyperaesthesia and nervousness in the affected kittens whereas the converse was found to be the case. This apparent anomaly may be explained, at least in part, by the fact that the kittens suffered considerable pain during excessive exertion and may have conditioned themselves as a result.

Aetiology

The exact aetiology of this condition is not yet fully understood and it is only possible to put forward some tentative theories. At this stage, the most significant single factor in the causation of the disease appears to be dietary. Enquiry into the diet of affected kittens and their dams revealed that they were maintained almost exclusively on raw meat and water. The most severely affected kittens had received no milk since being weaned, the owners being informed by the breeder that Siamese cats would not drink milk. It is interesting to note that a similar syndrome of osteodystrophy can be produced experimentally in kittens by feeding an entirely meat diet from weaning.

The cause of the thyroid adenopathy appears to be rather more obscure. However, it may be the sequel to an earlier phase of thyroid disease and a similar regressive phase of the thyroid histology has been observed at birth and even in aborted foetuses. Therefore, it is reasonable to presume that the causal factors have been operative actually *in utero* but that the condition has been aggravated subsequently by an inadequate diet.

Investigation of a possible hereditary factor as the causation of the disease did not provide any positive evidence. Naturally, with so few animals to investigate it is difficult to be conclusive, but examination of the available pedigrees did not reveal any one strain or bloodline common to all the kittens.

Treatment

Treatment of this condition has so far been purely empirical and has resulted in only one successful recovery.

The first consideration is correction of the diet; it is advised that cow's milk or milk foods be given along with a high protein diet and calcium in an assimilable form. We favour dicalcium phosphate and also advise supplements of vitamins A and D.

Bi-weekly injections of vitamin B_{12} (0.25 mg. per dose) have also been given to maintain condition and appetite, and aneurine hydrochloride 1 mg. has been administered orally each day to restore normal nerve metabolism. In addition, it is also advisable to rid the kitten of any possible Ascarid infection, for which purpose piperazine citrate has been found very efficacious. Treatment for secondary conditions such as cystitis may also be required. If pain is severe, a suitable analgesic may be prescribed.

In a recent case (November 29th, 1958) concerning a 12-week-old Siamese male kitten, the typical changes of osteodystrophy were observed on X-ray along with an impacted fracture of the proximal third of the right femur. The treatment of this case has been augmented by weekly injections of vitamin A in a dosage of 100,000 I.U. given intramuscularly.

In the majority of cases there is little or no improvement in spite of the treatment, and eventually the kitten dies or has to be destroyed. In the case of the one kitten which recovered completely, it must be pointed out that though unable to stand, it did not suffer from a complete paraplegia. It regained the ability to stand in 4 to 5 days but the paresis persisted during walking for some weeks. After a period of about 6 weeks of reasonable activity it suffered a relapse, with a return of the symptoms in a milder form. There has been no further recurrence since then but it took 3 to 4 months for full activity to return. A full sister of this kitten from a previous litter had to be destroyed after sustaining a fractured spine as the result of a fall.

Acknowledgments.—Our grateful thanks are due to Mr. M. G. Scott of the Royal Veterinary College for his detailed reports on the *post-mortem* material, and to Dr. P. P. Scott of the Royal Free Hospital School of Medicine for the X-ray photographs and photomicrographs.

HOLIDAY EXCHANGE

Poland

A young Polish veterinary surgeon is anxious to acquire a knowledge of British methods and would like to help a veterinary surgeon practising near London. He would be willing, if necessary, to give his services in exchange for hospitality. Any veterinary surgeon who is interested should communicate direct with Mr. B. W. Pacanowski, c/o 8, Sidney House, Woodstock Road, London, W.4.

G. L. B. HENDERSON & E. K. KEYWOOD.—AN OSTEODYSTROPHY IN SIAMESE KITTENS

FIG. 1.

FIG. 2.

FIG. 1.—X-ray of 20-week-old Siamese male kitten showing rarefaction of bony skeleton and displacement of the sacral vertebrae.
FIG. 2.—X-ray of 20-week-old Siamese male kitten showing impacted fractures of the femur and the tibia.
FIG. 3.—X-ray of 20-week-old Siamese male kitten showing rarefaction and impacted fractures of the limb bones.
FIG. 4.—Photomicrograph of normal thyroid gland.
FIG. 5.—Photomicrograph of thyroid gland from an affected kitten.

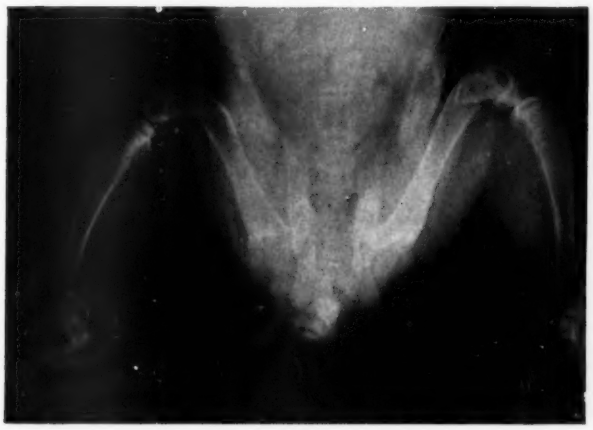
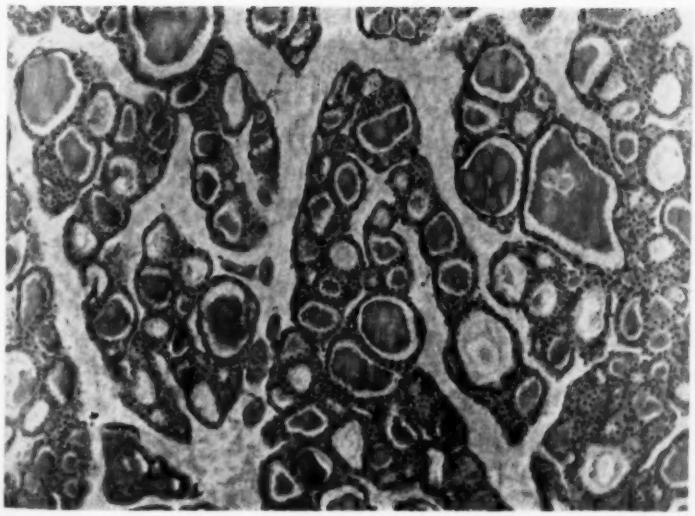
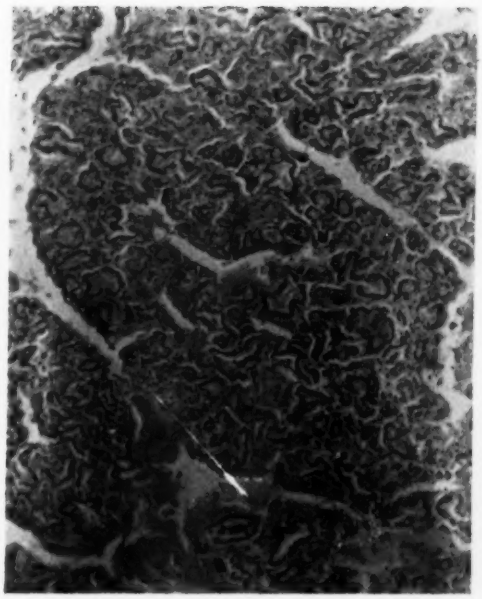


FIG. 3.

FIG. 5.

FIG. 4.





Biological Spare Parts*

BY

W. J. DEMPSTER

Department of Surgery,
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SINCE man is to some extent a machine, the question of the supply of new parts for old constantly occurs. For many centuries certain parts have been made good by the introduction of inanimate objects such as wooden legs and, recently, mechanical limbs, dentures, and contact lenses; spectacles, of course, have quite a long history. Biological spare parts are recent innovations and a brief review of the present situation will now be given.

There are three main problems involved in providing biological spare parts. These are the supply, the application, and the successful incorporation of the spare part. We usually refer to the spare parts as grafts or transplants. The supply of spare parts can be either from a person's own body (as in skin and bone grafts, or ileum to replace bladder, colon to replace oesophagus, or jejunum to replace stomach) or from another person's body (such as cornea, blood, blood vessels, kidney, bone, and bone marrow). A piece of tissue taken from one area and placed in another area of the same person is called an autograft. If a spare part is supplied by another person of the same species it is called a homograft. The former is usually successful and the latter is usually unsuccessful. Before we proceed to consider why homografts are usually unsuccessful, we should mention biochemical spare parts. Hormonal deficiencies can be made good by biochemical synthesis. Here is a recent advance which is of very great clinical importance.

The importance of pursuing the problem of organ replacement is not because there will be a wide clinical application once the fundamental problems have been solved, but because of the gravity of the occasion on which such grafts will be used. In irrecoverable renal disease, for example, there is no means of saving life other than by supplying new kidneys. On the other hand, the problems of sexual rejuvenation pursued so assiduously by Voronoff in a past generation are being, and will, no doubt, be solved by the administration of quite trivial biochemical products.

Another reason for pursuing this problem concerns ourselves—for we are all homografts. There is a very rigid separation between the maternal and foetal circulations. If antigens pass from the foetus to the mother antibodies are found which pass into the foetus. The effects of such antibodies are not well understood but are thought to cause such diseases as congenital bleeding of the new-born and renal disease. In time, no doubt, many other diseases will be attributed to this cause.

* A paper read to the Central Veterinary Society on March 5th, 1959.

The Physical Basis of Homograft Rejection

We will consider now why it is that tissue exchanged between two people of the same species will not survive indefinitely. One clue to the underlying problem is that tissue can be successfully and permanently exchanged between uniovular twins. This suggests that there is a genetic basis. The general process underlying the rejection of homografts is widely accepted as involving an antigen-antibody reaction, *i.e.* an actively acquired immunity on the part of the host. So the problem lies somewhere in a no-man's-land where genetics and immunology meet.

The evidence for the genetic basis is as follows: tissue can be exchanged between members of an inbred strain of mice or rats. Skin and kidneys can be exchanged between identical twins in humans. Skin can be successfully exchanged between dizygotic twins in cattle because they are synchorial, *i.e.* their circulations are confluent *in utero* and they are born with identical blood groups.

The evidence for what has come to be known as the immunological basis of homograft rejection is as follows: skin grafted between two members of the same species survives some days (or even weeks in humans) and then suddenly sloughs. If a second skin graft from the same donor to the same recipient is applied, it will slough very much more quickly than the first. This accelerated rejection can also be demonstrated in kidney homotransplants. If the second challenge of skin comes from another donor no such accelerated rejection occurs. From these experiments, it has been concluded that an actively acquired immunity has been involved, that it is gene-transmitted, and that it is individually specific. No precipitating antibodies have been demonstrated in the serum of recipients of foreign tissue. It is thought that the antibodies may be contained within the lymphocytes and liberated locally on the graft surface. It has also been shown that if tissue from one inbred strain of mice is injected into embryos of another inbred strain the latter will accept in adult life the tissues of the donating strain. This is called immunological tolerance.

Graft-host Relationship

For some time this was considered to be the whole story. The graft was regarded as an inert object awaiting inevitable destruction by the host. I have never taken this attitude. Work on homotransplanting kidneys impresses one with the vigour with which such organs can function right up to the moment when some, so far undiscovered, calamity overtakes them and function ceases. Histologically, these kidneys show evidence of what can be interpreted as an

attempt at forming antibodies against the host. One can see large numbers of immature plasma cells in the interstitium of homo-transplanted kidneys. Such cells are thought nowadays to be the centre of antibody manufacture. This concept of the graft's reaction against the host has been well demonstrated in other tissue systems. For example, if spleen cells are injected into embryos not only will the adult animals become tolerant to the donor's tissue, but a certain number die or become runts and this is considered to be due to antibodies emitted from the spleen cells. It has also been shown that if bone marrow is given to total body irradiated animals good recovery takes place only to be followed at a later date by death of these animals —due, it is thought, to antibody derived from the donated bone marrow.

In the ordinary life of a homotransplanted organ, it is highly probable that the stage of actual antibody production against the host is not reached before death of the organ occurs. It is also unlikely that the mobilisation of the defence cells (*i.e.* the immature plasma cells) contributes to the disintegration of an organ like the kidney in the homotransplanted state. This aspect only becomes of importance in a situation where the host might tolerate the kidney, but the kidney is not tolerant of the host. In that situation, a homotransplanted kidney might continue to produce immature plasma cells in such enormous quantities as to jeopardise the life of the organ. It has been shown that the homotransplanted adrenal and ovary can also react against a host by producing immature plasma cells.

Kidney Transplants

The homotransplanted kidney goes through a fairly well defined natural history. It starts to secrete within a few minutes of establishing the new circulation. It then rapidly enlarges to about twice its normal weight within 72 hours. It still continues to secrete and the blood flow at this stage appears to be adequate. One day, quite suddenly, the kidney becomes anuric. The period of survival varies a great deal. A similar sort of history could be given for most other tissues in the homografted state. From these natural histories it is obvious that there is no technical reason for their ultimate failure. If a homotransplanted kidney is removed from its host soon after cessation of function, little abnormality is to be seen. There are no obvious visible signs of an antigen-antibody reaction. For this and other complicated reasons, it has been suggested that a homotransplanted kidney brings about its own destruction, and that only at a later date does the host become actively immunised.

Kidneys can be successfully exchanged between human identical twins. In some cases prolonged survival of the kidney has been reported. In other cases, the transplanted kidney has succumbed, after a few months, to the same nephritic process which had destroyed the recipient's own kidney. This is a bitter disappointment because it means that amongst uniovular twins, selection must be introduced so as to avoid transplantation in those suffering from an acute or subacute form of nephritis. The best results so far are in those chronic cases who are not subject to frequent exacerbations of nephritis.

Skin Homografts

Skin homografts are invariably unsuccessful except when exchanged between uniovular twins. They can, however, be useful in providing temporary skin coverage in extensive burns. Such skin homografts will survive 2 to 3 weeks and so give the plastic surgeon time to cover the burned area with skin autografts at staged operations. It is obvious that many operations, and prolonged stay in hospital, would be avoided if a solution could be found to the problem of skin homograft rejection.

Corneal Grafts

Certain types of eye disease can be cured by successful corneal grafting. The graft is usually a full-thickness one since the optical results of the lamellar grafts are frequently unsatisfactory. Corneas can be removed from cadavers and stored in 15 per cent. glycerol in Ringer solution or in liquid paraffin at −79° C. There are several problems peculiar to corneal grafts; indeed, there are problems peculiar to all kinds of grafts. Only about 50 per cent. of all corneal grafts are successful. The failures are manifested by opacification due to various unknown causes. A failed corneal graft is not rejected by the host as is a skin homograft or any other type of graft. It has failed because its refraction is impaired by the ingrowth of blood vessels or clouding. It has still not been clearly demonstrated why some corneas survive indefinitely. There is no doubt that the cornea does contain antigen and that the cornea can produce antibody if adequately stimulated.

Vascular Grafts

Blood vessels have been repaired by homografts of blood vessels and by plastic materials. Blood vessel grafts, like bone grafts, are gradually replaced by host tissue. By the time this has occurred, they have achieved their purpose. A blood vessel graft is expected to conduct blood along it and so long as it does this it is successful. The histological appearances of a long-established artery homograft are rather alarming. The elastic membranes are usually broken up, there are calcium deposits in the media, and the muscle is largely replaced by fibrous tissue. In spite of this a vessel homograft can carry out its function very adequately. One of the many problems is the supply of blood vessels which can very often be quite difficult. Quite an elaborate organisation is required. The introduction of nylon material has overcome this problem and it is quite probable that such substitutes, constantly undergoing improvement, will come to be the material of choice in the future.

Bone Grafts

There is no doubt that bone autografts heal more quickly than homografts. Healing of a bone graft is largely dependent upon the re-establishment of blood vessels in the Haversian canals. In the case

of the bone homograft, most of the living cells are destroyed by the host and then only at a later date is re-vascularisation achieved. However, a bone graft is expected to act as a strut and this can be achieved by inserting bone derived from the same person, or from another, and it matters little whether the bone is fresh or has been preserved.

Heart and Lung Transplants

Hearts and lungs can be transplanted, but there are many technical problems involved and little progress has been made.

Bone Marrow Grafts

Bone marrow grafts have recently been introduced for the treatment of leukaemia, cancer, and accidental severe total body irradiation. In the treatment of leukaemia, the patient is deliberately subjected to lethal doses of X-rays and thereafter given intravenous injections of bone marrow taken from another person. It has been shown that this form of treatment can effect a rapid improvement in the clinical condition since the marrow cells populate the recipient. In mice it has been shown that after lethal doses of X-rays which normally kill in 10 days, bone marrow injections can prolong survival for some months. After this time the animals start to die. It is thought that this secondary disease is due to the reaction of the foreign bone marrow cells against the tissues of the host.

Bone marrow grafts are life-saving in cases of accidental exposure to irradiation. Long-term follow-up results are not yet available in the human and so it is not yet clear what the final outcome will be. There are two possibilities. It may be that some of the native bone marrow has survived the irradiation and, given time, will regenerate and destroy the foreign blood cell population. If this does not occur, the foreign blood cells may react against the tissues of the recipient and initiate a disease process leading to death.

In general, then, foreign tissue can evoke in its host a reaction against it. In addition, if the host is rendered immunologically incompetent (as after total body irradiation, for example), the graft can react against the host. Therefore, before successful homografting can be achieved, the immunological systems of both graft and host must be rendered inactive. It is difficult to see how to solve this problem at the moment and it would seem that some time will elapse before any solution emerges.

AWARD OF AN R.C.V.S. FELLOWSHIP

At a meeting of the Council of the Royal College of Veterinary Surgeons on March 20th, it was resolved that the Diploma of Fellowship of the Royal College be awarded to Professor J. F. A. Sprent, D.SC., PH.D., for a thesis entitled "The Large Roundworms of Cats and Dogs—a Public Health Problem." The Diploma will be conferred at the next Annual General Meeting of the Royal College. Professor Sprent qualified in London in 1939 and is Professor of Parasitology at the University of Queensland, Brisbane, Australia. This Fellowship is the first to be awarded under new regulations which came into force in January, 1957.

Castration in the Cryptorchid Bovine Animal

BY

BALLAV N. PATRA

Cuttack, India

CRYPTORCHID animals present a problem to the Indian farmer; they have all the male instincts of a bull and they are not docile working animals. Unless they are castrated they are useless as they are good neither for draught nor for breeding purposes.

O'Connor (1956) prefers castration by approach through the inguinal canal, and when the operation is to be performed through the flank he advocates section of the testicle after drawing it outside by way of the operation wound. Frank (1953), quoting Bemis (1930) reports equal success in castration by approach both through the inguinal canal and the flank in equine animals.

Case 1

A 5-year-old local Brahmin animal was brought for castration. The owner stated that the right testicle had been removed through the scrotum a year before and the left one could not be found then. The animal was restless, unwilling to work, did not care to feed, ran after cows, and was going down in condition.

Palpation revealed nothing in the inguinal canal as far as the fingers could reach. Rectal palpation revealed the testicle on the left side, behind the left kidney, at a level below the transverse process of the fourth and fifth lumbar vertebra. It was the size of a small tangerine. It was slippery to the touch and the extension of the spermatic cord at the ends could be clearly felt.

The animal had been starved for 12 hours to facilitate examination and so immediate operation was decided upon.

The skin in the region of the left flank was shaved cleanly, washed with soap, and disinfected by rubbing with spirit on a piece of gauze held by dressing forceps. Acriflavine in spirit (1:1,000) was poured on liberally and rubbed into the area. The operation area was anaesthetised by local infiltration by 2 per cent. solution of procaine hydrochloride in distilled water.

An incision 4 inches long was made in a slightly slanting manner from an inch below the third lumbar transverse process to the base of the sub-lumbar fossa. After incising the skin, the subcutaneous muscle and fascia were cut through by forceps and scissors and then a corresponding opening was made in the oblique muscles of the abdomen. The fibres of the transverse abdominis muscle running in the vertical direction were torn through exposing the peritoneum, this in turn was cut through parallel to the incision by forceps and scissors, taking care that none of the structures underneath were torn or cut. One hand was introduced through the opening into the abdominal cavity. The testicle was traced in the cavity lying suspended by a wide fold just below

the fifth lumbar transverse process and the sacrum, a little in front of the pelvis inlet. Traction on the testicle revealed that it could not be drawn far enough to be brought out through the flank opening. The testicle was therefore drawn and twisted and cut by introduction of an emasculator through the operation wound. After severing the testicle the emasculator was kept in position for about 5 minutes to prevent any haemorrhage. The emasculator was manipulated inside the abdominal cavity by feeling with the right hand while the handle outside was manipulated by the left hand to cut the testicle, while an assistant helped to hold up the instrument.

After feeling round the stump for bleeding the operation wound was closed, layer by layer, using Vitafil as suture material for the peritoneum and for each layer of muscle separately. The skin was closed by interrupted sutures using silkworm gut as suture material and a pad of gauze soaked in spirit-acriflavine was placed on the wound and held down by retention sutures.

The recovery of the animal was uneventful.

Case 2

The subject was a cross-bred Sindhi bullock 4 years of age. Palpation *per rectum* revealed the testicle at the superior aspect of the right side of the pelvic brim below the sacrum. The left testicle had been removed earlier as it was situated in the normal position in the scrotal sac.

The same mode of operation described in the previous case was performed, the testicle being removed through an entry made into the abdominal cavity from the flank of the animal.

Recovery in this case was uneventful also. On the third and fourth day of operation the animal was given 50 c.c. of 33.3 per cent. solution of sodium sulphadimidine* as an additional precaution. The testicle removed weighed 2 oz. and had 2 cystic growths on the side of the epididymis. It was so placed in the abdominal cavity that it could not be drawn outside through the opening made in the flank into the abdominal cavity.

Conclusion

Cryptorchidism is not a rare condition in the local types of Indian working cattle. In many cases the testicles are abdominal and can be easily palpated *per rectum*.

Surgical operation for their removal can safely be done through an opening in the flank to enter the abdominal cavity. The testicle or testicles can be removed by the use of an emasculator, from the abdominal or pelvic cavities as in most cases they cannot be pulled outside through the operation wound.

The operation can be carried out under field conditions with reasonable safety. This method of castration can be done with the animal in the standing position, and so the difficulties of control and the risk of possible herniation, which may follow the operation if it is performed through the inguinal canal, are avoided.

Acknowledgments.—To Dr. Biswal, Principal, Orissa College of Veterinary Science and Animal Husbandry, for facilities provided, and to Mr. Mahanti and others of my staff who assisted me.

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* Sulphamezathine: Imperial Chemical (Pharmaceuticals) Ltd.

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Recent Advances in Artificial Breeding*

BY
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THIS Science is relatively so new that the whole subject could justifiably be regarded as a "recent" advance. It would also give a distorted view, to disregard the progress of the last 30 years completely. I will, however, not dwell on those events which are fast becoming history, except to give background to the trends of modern developments.

Primitive beings were incapable of visualising the make-up of modern man. In the same way, at this moment of history, few accept that our mutant descendants are bound to be different from ourselves, who, after all, are but genealogical links in an evolutionary chain. Each generation, however, produces glimpses of the future in men born apparently before their time. Particularly is this recognisable in scientists and often such men have been labelled heretics. The science of reproduction provides no exception. Leeuwenhoek's fantastic observations of spermatozoa in 1677, using microscope lenses he had made himself, were revolutionary. And how intrigued Spallanzani would have been to know the extent the world had benefited indirectly by his experiments on fertilisation with dogs in 1790. Deservedly indeed is his name honoured in the Lazzaro Spallanzani Institute in Milan.

The abyss of about 120 years of inactivity following these discoveries was only bridged when, at the turn of this century, the world groaned under its burden of rapidly multiplying communities. If famine were to be averted, it became obvious that greater food production was essential and agricultural invention was born out of dire necessity.

Even by the end of the First World War, in Russia, the artificial insemination of horses, cattle and sheep was gathering momentum. By the end of 1937 over 1,000,000 cows had been inseminated in that country (Goode & Rudduck, 1948). Denmark also achieved remarkable progress, for, starting in 1936, half of the

* Paper presented to the British Caribbean Veterinary Conference, 1958.

female cattle population were being bred artificially in 1951 and, 4 years later, 96 per cent. of the total were being inseminated! In Britain, a complacent stasis precluded real development until 1942, when pioneers began pressing their cause more forcefully. By 1957, however, about 60 per cent. of the available cattle were inseminated, indicating that the Briton readily seizes his opportunity once he is sure that the change is for the best.

This remarkable development and continuing spread of the use of artificial breeding testifies to widespread enthusiasm and satisfaction. Certain milestones in the form of technical improvements have marked the progress and have contributed to expansion and further acceptance of the practice during the last 20 years. The monumental review by Emmens and Blackshaw details these developments and provides one of the most comprehensive reference lists obtainable (1956).

Nutrient Extenders

Egg-Yolk Buffers

1. The protective nature of egg-yolk exploited in the diluent of Phillips and Lardy (1940), which incorporated a phosphate buffer system, made semen extension and preservation for a few days possible both reliably and cheaply. The phosphate was popularly superseded by the sodium citrate buffer of Salisbury and his co-workers (1941) largely owing to the comparative clarity with which the spermatozoa could be viewed under the microscope.

Bacterial Control

2. Diluents optimal for preserving the longevity of the spermatozoa usually favour bacterial growth as well with the result that, commencing in 1948, various chemotherapeutic and antibiotic substances were tried as additives as they became available. Sulphanilamide, penicillin and streptomycin are those commonly used nowadays (Salisbury & Knodt, 1947; Almquist, 1949; Willett & Ohms, 1955). Not only was the preservation of fertility upheld longer, but bulls whose conception rates were low achieved higher levels of fertility when their semen was used in diluents containing one or certain combinations of these additives (Erb *et al.*, 1955 ; Willett & Ohms, 1955). A lessening of embryonic mortality in part accounted for the enhanced fertility and this pointed to a degree of control in transmitting diseases through semen as the reason (Fechheimer, Ludwick & Ely, 1952 ; Willett *et al.*, 1955).

A satisfactory level of fertility—about 68 per cent. of cows showing no return to oestrus at the end of 120 days—is now almost universally achieved.

Milk

3. A major blow to the cost of existing diluents was struck by the re-introduction of milk as an extender by Weiss and others (Weiss, 1951 ; Laplaud *et al.*, 1951). On a world-wide scale comparable levels of fertility have been achieved using heat-treated skim milk with added penicillin and streptomycin. In countries in which foot-and-mouth disease is indigenous a certain amount of warrantable nervousness is felt in using fresh milk diluters (Madden, 1956), because of the potential danger of introducing the disease to A.I. studs through improper handling of the milk, quite apart from the catastrophe which would ensue if the infected milk diluter were not heat-treated properly prior to use. Dried milk powders may be free from suspicion, according to their mode of manufacture, and these give satisfactory fertility levels (Melrose, 1956).

Ideal Diluters

4. The search goes on for an extender which is optimal on all counts. Ideally the diluting fluid should (*a*) be capable of supporting normal fertility for as long as possible ; (*b*) be cheap and simple to produce ; (*c*) be water clear so that unimpaired evaluation of motility is unquestionably achieved ; and (*d*) be reproducible exactly for each batch. Diluents containing large proportions of animal material will always be haphazard with regard to their make-up and it was with this in mind that a renewed attack on the problem of a synthetic diluter was made in the laboratories of the Hampshire Cattle Breeders' Society. In a private communication, Madden tells me that in January, 1955, a small field trial involving 429 first inseminations resulted in a conception rate at 90 to 120 days of 68·3 per cent. (insignificantly but nevertheless actually 4 per cent. higher than from the contemporary yolk-citrate)—using a chemical diluent containing sodium hexametaphosphate, potassium citrate, magnesium sulphate, peptone, lecithin, glycine and fructose in distilled water. It is interesting to note that the sodium hexametaphosphate was used partly for its buffering power and partly for its detergent properties in dissolving the other ingredients to provide a water-clear microscope picture. It is Madden's impression, however, that a great variety of more simple chemical diluters would be adequate to support normal fertility, if the semen were used on the same day as it was collected (as in this particular field trial), and indeed a number of synthetic extenders have been tried.

In the United Kingdom, with relatively small distances for despatch, the need for using fresh semen over 24 hours old with the attendant potential of lowered fertility (Aamdal, 1952 ; Cembrowicz, 1952 ; Campbell, 1953 ; Hewetson, 1955 ; Stewart, 1950) is now hardly a necessity. Frozen semen, achieving a conception rate of no less than fresh semen of 24 hours old extended in egg-yolk citrate (Madden, 1956), fills the gap until a bull is collected from again, with the minimum of semen wastage.

Diluters Based on Metabolic Suppression

5. Nevertheless, it would be of immense value if a method more technically simple were devised, which would sustain first-day fertility for a week or 10 days. We look forward with anticipation to Vandemark's laboratory for confirmatory fertility data using the Illinois Variable Temperature diluter with its use of carbon dioxide as a suppressor of metabolic activity (1956). Similarly we seek confirmation by means of extensive trials of Stowers glycine diluent (1958).

Temperature Control

6. The question of using ordinary refrigeration temperatures for enhancing the keeping quality of fresh semen *for short periods* might well be reconsidered. Although it would be wrong to transpose the conclusion from another species, it does appear, for instance, from our pig A.I. experience, that the freshly diluted semen both in yolk-citrate or yolk-glycine extenders, is best served up " hot," as it were (+15° to 20° C.) rather than as a chilled confection (Aamdal, 1956).

Deep Freeze

Mention has already been made of frozen semen, undoubtedly the greatest technological advance of the decade, discovered by Polge *et al.* (1949). This technique has since become a veritable playground of so many research establishments that it would be invidious to attempt to enumerate them. Despite the enormous amount of work which has been published concerning the optima in the freezing procedure, it is striking that the fertility of samples processed by the methods of Polge and his co-workers (1952) has hardly been improved on—except by judicious selection of particularly capable bulls ! Perhaps, however, it would be unfair not to give credit to the introduction of 7·5 per cent. glycerol (Emmens & Blackshaw, 1950) and thereby the apparent ability to freeze more successfully on the day of collection, providing a potential means of obtaining the conception rate of first-day semen.

May I take the liberty of reminding all those concerned in this type of work that, both from a qualitative viewpoint in the laboratory and for fertility in the field, the biggest factor one must heed in the evaluation of results is the variability between the individual doses issued (Madden, 1955). Qualitative assessment for judging improved methods may be valid statistically on averages, but where the individual differences in a batch are marked and the dilution rate is not cautious, over-all fertility will suffer. Uniformity of dose should be sought on a par with quality, so that more correct random assessment can be made and the individual unit chances of fertilisation made equal. Standardisation is the essence of success in the splitting up of any processed biological material into units. Consider a frozen batch of semen, diluted at 1 in 40, the cursory examination of which appears to reveal that it is only 50 per cent. alive and just adequate for use. Due regard must be paid to the fact that this semen is now, to all intents and purposes, diluted at the rate of 1 in 80 and one might have hesitated before putting a medium density sample even in fresh dilution at that rate into the field. Examination of a sufficiently large number of doses of the batch may well reveal that some 10 per cent. of the ampoules contain semen only 40 per cent. alive and even less, particularly if the semen is from a so-called " badly freezing " bull, where the ampoule quality spectrum is broad. Beware that the equivalent dilution rate of the inferior ampoule is potentially 1 in 100 or more ; even with that sperm remaining alive it may well be attenuated more than that in the 50 per cent. alive ampoule. Indeed, it is small wonder that in the levels of fertility experienced with some bulls, frozen semen is disappointing if not critically judged and culled on this basis.

I find it surprising that, with the interest research laboratories have shown in deep-freeze work, some more effective approach has not been made to prevent killing spermatozoa entirely in the processing. Is the hypothesis correct that spermatozoa are subjected to a " pickling " effect caused by the increase of osmotic tension in the residual fluid as ice crystallisation develops ? Or is the killing more in the nature of a " cold shock " effect ? It would appear that it is surely not beyond the bounds of possibility to contrive a diluent in which this damage-provoking phenomenon does not occur. So far, improvements producing greater live proportions have been only by degree—the real fundamental fault escaping attention. Why, for instance, do occasional samples freeze with practically no sperm mortality ? A light may be cast on this by Madden's experience with some completely infertile Guernsey bulls whose semen contained 100 per cent. decapitated spermatozoa—a fair proportion of the tails swimming vigorously on their own ! These bulls are rarely met with (Hancock & Rollinson, 1949), but the 4 the Hampshire Cattle Breeders' Society has encountered on farms in the past 18 months have produced samples which have frozen down with scarcely any further loss of tail life (Madden, 1957–8), tending to support the osmotic theory of damage.

One last word in this brief comment on deep freeze. The American refrigeration industry has produced mechanical deep-freeze chests which appear to be working satisfactorily. It is likely that the demand in Britain will stir the ingenuity of British refrigeration experts who have so much to their credit in that intricate field of science.

The development of using liquid nitrogen as an economic coolant has so far not been made possible in Great Britain, although its use in the U.S.A. is gaining popularity in its provision of maximal storage capacity and a wider temperature safety margin. Insulated holding boxes are in common use in Great Britain and, despite the enormous amounts of solid carbon dioxide replenishments used, they are undoubtedly cheaper there than mechanical units both in capital expenditure and running costs. In the Hampshire Cattle Breeders' Society we have returned to the simple flat surface " seal " for the lids of these chests instead of wedge or stepped types. These work very satisfactorily indeed and are much simpler and cheaper to make. No sticking occurs if an air-space of about 3 to 5 inches deep is allowed between the undersurface of the lid and the alcohol and dry-ice level. The small technical advances such as this and in laboratory work with deep freeze are far too many to enumerate. Very often they are special adaptations for local requirements and these may not be suitable for universal application.

The commercialisation of A.I. and its widespread use preceded our theoretical knowledge by many years. Even now the avenues of new thought and research are manifold. The care and handling of semen has undoubtedly improved over the years and

small advances are made almost daily. Shortage of time and space preclude a review of these items in this paper. The A.I. centre's prime purpose is to issue semen of the highest quality possible.

Teasing

Taking a broad view, I single out the preparation of the bull for ejaculation as one of the major contributions to providing top quality semen. The early workers advocated " teasing " prior to mounting, but this conditioning degenerated into such a routine procedure that the stimulus was no longer effective. The customary practice was to get the bull out just prior to collection and, whilst the collector waited a few minutes, the bull was led up to a crated teaser about 3 times and then allowed to serve into an artificial vagina. Samples truly representative of the bull's semen-producing capabilities were rarely obtained. Following the late Brian Kerruish's renewal of the theories and practice of real frustration (Hellstrom, 1947) and optimal ejaculation (Kerruish, 1955 ; Almquist, 1956 ; Branton *et al.*, 1952 ; Collins *et al.*, 1951 ; Crombach *et al.*, 1956), it has become our routine to frustrate bulls for up to half an hour prior to collection. One optimal ejaculate is obtained per collection day which recurs every 4 to 7 days. Volume and density are certainly enhanced materially and, we feel, the actual motility is improved—possibly by hormonally induced additives to the ejaculate (Madden, 1957). Optimal teasing requires a very fine degree of skill in handling and judgment on the part of the stockmen. Skilful collection is dependent not only on the deftness of the collector, but optimum results are only achieved by the unison and harmony of the quartet (bull, stockman, teaser and collector). Where one of these factors is inferior—but particularly if it be the collector—semen of almost incredibly low standard, by comparison, will result. The futility of attempting to judge a bull's capabilities under anything but optimal conditions is thus very apparent. In an A.I. Centre, if optimal teasing is not practised prior to collection, semen quality may suffer and commence a vicious circle of over-use with resultant low fertility which will only improve after sexual rest (Gould & Bennett, 1950). Individual bull's semen may suffer by excessive frequency of collection but it is now generally agreed that the majority of mature bulls have prodigious powers of libido, and semen production if optimally frustrated and handled.

Electro Ejaculation

Modern modifications of Gunn's original technique for rams has been applied successfully to bulls by many workers (Dzuik *et al.*, 1954 ; Laplaud *et al.*, 1951 ; Marden, 1954 ; Rowson & Murdoch, 1954 ; Thibault *et al.*, 1948). Probably the technique is best limited in application to bulls whose inability to mount is the direct result of trauma, and caution should be taken before making use of the method in cases where the disability is likely to be of an hereditable nature—in view of the possibility of transmitting the defect which is being overcome artificially. In particular warning should be taken when lowered libido is the reason under consideration (Bauer, 1956 ; Couttie & Hunter, 1956 ; Lagerlof, 1950).

Insemination Techniques

It is generally accepted that individual technicians, because of psychological factors, may undergo periods during which there is apparent impaired fertility in the cows in their territory (Smith, 1956). Careful supervision is an essential of good administration and every effort should be made to restore confidence which is a prime requisite for inseminators coping with large numbers of cattle.

The technicians must be provided with optimal equipment. The rectal technique has proved superior to that using a vaginal speculum (Hendrikse & Van Der Kaay, 1950) and is almost universally employed nowadays. For newly presented cows, it is usual in Great Britain to deposit the semen at the bifurcation of the uterine horns for maximum fertility. Repeat services are very often performed only within the cervix to lessen the risk of upsetting existing pregnancies—at least 4 per cent. of repeat breeders being detectably in calf (Donald, 1943). Intraperitoneal deposition and cornual puncture, although technical triumphs (Fechheimer *et al.*, 1952 ; Skjerven, 1955), must be limited to cases where ease of entry by normal methods is *not* prevented by hereditary conditions.

Major advances have been made—mainly in the United States—using plastic dispensable equipment. From an efficiency viewpoint, as well as for veterinary and hygienic reasons, the modern A.I. Centre should run on plastic equipment with all its attendant advantages : the occasional embarrassment caused by broken insemination pipettes would be largely prevented and the risk of transmitting diseases from cow to cow minimised. Once individual inseminators have overcome the initial difficulties of the technique, the conception rates are equal to those which have been obtained with glass pipettes. When the labour and aggregate cost involved in cleaning and sterilising equipment is taken into account realistically, there is little difference in running cost, providing plastic pipettes are available at about 1½d. each.

Timing of Insemination

Perhaps one of the greatest advances for commercial A.I. in cattle from the field angle is the acceptance of the fact that successful levels of fertility may follow insemination during quite a wide span of time during oestrus. Transport charges form one of the heaviest items in the expenditure of an A.I. Centre. The Hampshire Cattle Breeders' Society reckon to have made a saving of at least 10 per cent. in over-all mileage costs since the winter of 1956 when the system commenced of carrying out only inseminations requested prior to 10 a.m. on the same day as the message was received. The 90- to 120-day conception rate for 59,516 first inseminations under this method, 66·4 per cent., compared favourably with 55,062 first inseminations for the previous year of 66·5 per cent., when the system was to perform inseminations notified until 1 p.m. on the same day. This in no way, however, implies that there are not more highly fertile times than others relative to ovulation. From

a practical point of view, it is not possible to inseminate at the optimal time in every case, since this would be difficult even under experimental conditions.

Disease Aspects

Whereas dispensable equipment and rigorous attention to disinfection routine on the part of the inseminator can minimise cow-to-cow spread of disease conditions, the potential dangers of transmission should the diluted semen be infected are enormous.

With the ever possible danger of venereal conditions in the bull stud, two main viewpoints are expressed. A compromise between practical working conditions and the ideal is gained if it is presumed at the A.I. Centre that each bull may have a preputial infection and may be a potential source of danger to contacts or to the female population he is used on. Every effort is then made to minimise spread. Individual artificial vaginas with individual spare ones should be provided which are on no account exchanged between bulls even though they are sterilised. Sterile rubber gloves should be used by the collector and changed between handling different bulls. Steers should be used as teasers instead of cows, minimising cross infection by eliminating natural service. Rubber sterilisable flank sheets have been used, but allegedly they tend to put bulls off mounting. The teaser's flanks, possibly contaminated by penile contact or spurts of accessory fluid, should be scrubbed vigorously with disinfectant before the mounting by another bull is permitted. Much can be done to aid the elimination of preputial infections by the use of regular douching and massage with antibiotics.

Various forms have been used in the Hampshire Cattle Breeders' Society stud since October, 1952. These methods were not tied to tests on females, such as the Vibrio mucus agglutination tests, as these were not then readily available. Nowadays it is usual in most A.I. Centres to subject all new entrants upon arrival, and the whole stud every 3 to 4 months, to the hygienic measures prescribed by Steward *et al.*, using penicillin and streptomycin emulsion for 3 successive days at each treatment. An effective cure for vibriosis is thus applied, and the other preputial contaminants cleared routinely. These topical applications of antibiotics must be under the direct supervision of the veterinary surgeon in charge since the massaging is tedious and wearisome and might be skimped. Under no circumstances must even one treatment be applied in a manner less efficient than that prescribed. The housing must be thoroughly cleansed and disinfected and the bedding changed prior to the bull's return to his quarters after the first day's treatment. The bulls must be kept apart in such a way that there is no possibility of transmission of disease, particularly venereal conditions. Ideally individual quarters should be provided per bull with indirect access to the next. If, for reasons of economy or restricted space, the bulls are tied close together, their movements should be severely restricted to prevent contact and their bedding should be kept to a minimum ; the latter should be rigorously segregated and changed frequently.

Even where the above principles are adhered to, since no treatment could be 100 per cent. effective all the time, it is usual to include antibiotics in the diluent in order to combat further any susceptible bacteria which may so far have escaped elimination.

From an ideal viewpoint, however, infections should be sought by testing and, upon detection, eliminated either by culling or by treatment, the outcome of which is measured by some reliable form of testmating. This can be done for vibriosis but, largely owing to the expenditure involved, it is not practised widely in Great Britain yet. If group testing is performed initially, the number of wasted heifers may be cut considerably, providing infection is not widespread in the stud. If the test heifers are chosen wisely and the scheme managed soundly their subsequent sale for meat need not incur much of a loss. A co-operative scheme involving bulls from a number of studs is at the moment being devised by the Glasgow Veterinary College.

The antibiotic measures described above are practical hygienic steps. One would hesitate to abandon them even if the stud were proved disease-free regularly by testmating, and it is because of this that the value of testmating is questioned in view of the additional expense and trouble.

Fertility in A.I.

This is dependent on two major factors—the A.I. Centre and the bull. Some points from the farm angle have been mentioned—for instance, timing with regard to fertilisation. Possibly 90 per cent. or more of the cattle inseminated actually conceive to that first insemination. The drop in this percentage to the 90- to 120-day conception rate of 68 per cent. is entirely due to failure of the embryo at various stages. It would be purely speculative to lay some of the blame for this on what I might term the quality of fertilisation. For example, an attenuated spermatozoon having penetrated the ovum, contributes its make-up, but is defective in the necessary power to initiate the further development—a ferti isation destined for failure.

We do know, however, the full measure of importance of the uterine environment in the prosperity of the embryo. This organ requires a period of up to a month to regain its palpable position and tone after calving, but the conception rate tends to remain low until at least 50 days *post-partum*. Physiologically the uterine environment appears to improve in its capabilities to maintain an embryo, and thereafter improved fertility results if an interval of more than 60 days is allowed before service, ascending to a maximum level at about 90 days after calving. It would be a major advance indeed for the economical running of A.I. Centres if the farmer could be convinced of this and conception rates were thereby kept potentially at a maximum.

In a similar way, if scepticism and uncertainty could be overcome and the futility of performing repeat services within 10 days of the previous oestrus were fully appreciated, a number of wasted visits might be avoided. In the Hampshire Cattle Breeders' Society such repeat inseminations have a conception rate of 30 per cent. less than that achieved in cows whose

cycle is within the normal variation of 18 to 24 days.

The probability is that any major increase in conception rate above the 70 per cent. level would require tackling from the female angle. Probably the general practitioner is only allowed to see a distorted picture of female fertility in that he but rarely meets the " normal " animals of a herd, being preoccupied with the more clinical cases. It is really a terrible reflection when one realises that 30 per cent. or more embryonic failures pass by as " normal." Since, at the time of service, one does not appreciate which of the inseminations is destined for failure, one should assume that this catastrophe is imminent in every single case. Where success has followed the treatment of a " clinical " case of known embryonic failure, why should this not even more readily be applied with success to the " normal " group ? Surely it is time a research onslaught were made to provide more optimal conditions for the survival of the embryo either hormonally or antibacterially or both ?

Semen Evaluation

Although a considerable volume of research work has been directed to discover the key to fertility and innumerable facets have presented partial answers, the lock will probably never be opened. Extreme variations occur in many of the factors studied in samples supporting " normal " fertility and, in most cases, guidance is only obtained where fertility is likely to be extremely low through some pathological cause. This is usually known already from actual field work. The differentiation between samples supporting good fertility to very good, is impossible to measure on the basis of one factor. Even when many measurements of various kinds are made, fertility results supporting predicted levels would be quite coincidental, because of the unmeasured variables such as the influences in the field already discussed.

Nevertheless, the need for accurate semen assessment is indissolubly tied to the practice of A.I. for the proper keeping of laboratory records, which tend to replace individual opinions by factual measurements. Several recorded aberrations of one sort or another may aid interpretation of unusual field results which do not appear to have been affected more than normally by peculiar field conditions. Indeed, the judgment of a bull's fertility performance may, in the end, depend on laboratory data which support or counter field information.

There would appear to be some basis for further study in the theoretical possibility of certain familial tendencies for high fertility. Successful selection towards this end would probably be dependent on factors which lowered embryonic mortality.

Sex Determination

The dream which has gone hand in hand with the development of A.I. is, perhaps, slightly nearer fruition than at any period hitherto. We look forward with extreme interest to learn of the latest field trials Professor Lindahl has been carrying out in Sweden (1956).

Acknowledgments.—My grateful thanks are due to Mr. D. H. L. Madden, M.R.C.V.S., veterinary surgeon to the Hampshire Cattle Breeders' Society Ltd., for his full and generous co-operation in the preparation and writing of this paper and particularly his research into the literature and permission to use reports of his own as yet unpublished work.

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Current Literature

ABSTRACTS

Allergic Dermatoses in Small Animals. KRAL, F. (1958). *Vet. Med.* **53.** No. 12. 660-3.

This paper is a short review. After defining the term allergy, the factors thought to be associated with cutaneous allergies of dogs and cats are listed under the folowing headings: (1) foods; (2) drugs; (3) vaccines and sera; (4) chemicals; (5) arthropods; (6) bacteria, fungi, and viruses; (7) physical agents.

The clinical manifestations and histo-pathological changes seen in cutaneous allergies are described, and mention is made of diagnostic tests which may be of use. Advice on systemic and topical treatment is given and there is a brief note on human allergies developing from contact with animals. A. I. W.

Two Cases of Vascular Surgery in the Dog. DANN, J. R., & BLANSFIELD, H. N. (1959). *J.A.V.M.A.* **134.** No. 4. 171.

Although nearly all the preparatory work involved in human cardio-vascular surgery has been performed on dogs, it is very uncommon for these techniques to be applied to the dog for the relief of cardio-vascular anomalies.

The authors describe the surgical closure of a patent ductus arteriosus in an 8-week-old puppy, and a femoral embolectomy in an 11-year-old Wire-haired Fox Terrier.

The patent ductus arteriosus was diagnosed purely on the presence of a "machinery murmur" accompanied by a distinct thrill palpable throughout the lower half of the thorax. Routine thoracotomy was performed through the left fourth intercostal space, and the ductus exposed with little difficulty. This was divided between two coarctation clamps and the cut ends oversewn, using a running suture of 5-0 arterial silk on an atraumatic needle. It is pointed out that simple ligation of a patent ductus is accompanied by a significant incidence of recanalisation, and that complete division is the method of choice. Recovery was uneventful, although the persistence of murmurs following the operation has led the authors to suspect an additional intracardiac defect.

In the second case, the symptoms of femoral embolism were characteristically sudden in onset, with acute pain and right hind leg lameness. Examination under a tranquilliser ruled out the possibility of fracture but revealed coldness of the extremity of the affected limb, marked swelling of the gastrocnemius muscle, and the disappearance of the femoral pulse in the upper third of the femoral region. A diagnosis of femoral embolism was followed by immediate surgical measures to relieve it. The artery was exposed and an obvious swelling was seen at the point where pulsation ceased. The artery was isolated by blunt dissection and occluded above the swelling by a catgut ligature. Arteriotomy was performed through a longitudinal 10-mm. incision and the embolus removed. The distal part of the artery was then "milked" towards the incision, and further clots removed. The artery was closed with a running suture of 5-0 arterial silk, and no haemorrhage occurred from the suture line when the catgut ligature was removed.

Antibiotics and 100 mg. Heparin were given post-operatively, and 50 mg. Heparin was repeated every 12 hours for 3 days. On the third day increased warmth was noticed in the distal part of the affected limb, and the femoral pulse was detected on the fifth day. Further recovery was uneventful.

R. G. W.

Congenital Hip Dysplasia in Dogs. SCHALES, OTTO. (1959). **54.** No. 3. 143.

The responsibility of the veterinary surgeon in discouraging the breeding of dogs affected with hip dysplasia is the theme of this article. Although hip dysplasia is primarily due to a delay in proper development of the acetabulum, it may involve all the bony structures of the hip joint. The abnormality ranges from a loose fit of the femoral head into a reasonably deep acetabulum, to a nearly flat acetabulum which predisposes to early luxation. With progressive age arthritic changes become apparent, leading to subluxation and complete dislocation as an end result.

Dr. Schales briefly reviews published observations on the condition as seen in man, and points out that the genetic evidence of vonVerschurer in 1931 —that hip dysplasia in man is transmitted as a dominant characteristic with irregular manifestation —may be accepted as a working hypothesis as to the mode of transmission in dogs. In an attempt to justify this the author obtained data on the hip status of the parents of 106 litters which contained puppies suffering from hip dysplasia. One or both parents in 99 of the 106 cases showed evidence of hip dysplasia. He states that probably as many as 75 per cent. of German shepherd dogs in the U.S.A. have hip dysplasia, which he believes to be due to the deliberate selection of dogs for breeding by looks alone without considering their working ability.

Dr. Schales suggests that all breeding dogs that are suspect should first be X-rayed to eliminate the possibility of hip dysplasia and that should the condition be encountered, veterinary surgeons should strongly recommend against the animal being used for breeding.

Recent Advances in Artificial Breeding—*Concluded.*

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News and Comment

ADDITIVES IN FEEDING-STUFFS

The Compound Animal Feeding-stuffs Manufacturers National Association, the National Association of Corn and Agricultural Merchants, the National Association of Provender Millers, and the National Council of Concentrate Manufacturers, announce the introduction of a scheme for the voluntary declaration of the presence of certain additives in feeding-stuffs. The scheme, which has been agreed with the Ministry of Agriculture, comes into operation on June 1st, 1959, and covers additives in common use now, or likely to be so in the future, *viz.* certain coccidiostats and anti-blackhead drugs, and added copper. Additionally, manufacturers of animal feeding-stuffs will declare the presence of synthetic hormones when included in certain feeds.

Although labelling in a prescribed form is already compulsory for feeding-stuffs containing penicillin, aureomycin, and oxytetracycline, and for those containing sulphonamide coccidiostats and arsenical growth promoters there is at present no legal requirement to label feeds containing other additives. The Associations feel that the introduction of this scheme will meet the undoubted need for farmers and veterinary surgeons to know what additives are administered to livestock in the course of normal feeding.

PRESENTATION TO PROFESSOR MITCHELL

A very pleasant ceremony took place in the hall of the Royal (Dick) School of Veterinary Studies on April 10th, when members of the School's Alumnus Association presented to Professor Mitchell a portrait of himself which had been painted by the Edinburgh artist, Robert Lyon. On the platform Mr. E. Callender took the Chair with Professor Mitchell on his right and Mrs. Mitchell on his left, the other members of the party being Mrs. Callender, the President of the B.V.A., and Mr. J. E. Spreull, the Honorary Secretary of the Alumnus Association. In the body of the hall there were many of the members of the Council of the B.V.A., together with friends and old students of Professor Mitchell.

In addressing him Mr. Callender said that although gifts had been presented at the time of the Professor's retirement from the Directorship of the School, members of the Alumnus Association—all of them his old students—wanted to make a special gift of their own. They had decided that this should take the form of a portrait and in his (Mr. Callender's) view the portrait was an admirable piece of painting and delineated the sitter, who was so well known and so much beloved, with great success.

Professor Mitchell had served the Dick for many years with great distinction and had assured for himself a niche in the profession's history. His name would long be mentioned among the roll of great men in the veterinary profession.

Mr. Callender's speech was greeted with loud and prolonged applause. The portrait was then unveiled and it was seen that Mr. Callender's encomiums upon it were fully justified.

Addressing the meeting Professor Mitchell said that although he was addressing representatives of the whole profession he felt sure he would be excused if his remarks were directed in some degree towards his old students and the members of the Alumnus Association. Mr. Callender had praised the portrait and Professor Mitchell said the choice of the artist, who had been his personal friend for many years and who was Principal of the Art School, had indeed been a fortunate one. He believed there was some suggestion that his portrait should hang in the School, but he would not wish to take a place beside the great Charnock Bradley "for the time." He hoped the School would receive his portrait "later on."

Professor Mitchell recalled having entered as a student in 1905, and having been appointed to the teaching staff at a time when he and Professor Bradley were the only graduates and the total number of staff was but 17. Life in those days was totally different, and it was due to the genius of Charnock Bradley that the Dick occupied the position within the University of Edinburgh that it did to-day.

Professor Mitchell spoke humorously and modestly of his own services, deprecating their distinction, but saying how much the life and work of the School had meant to him throughout his career.

As he sat down those present left him in no doubt of the esteem in which he is held by his professional brethren; and when the applause had ended, Mr. Hebeler spoke. It was a happy coincidence, he said, that he, as a member of the Alumnus Association, should be President of the B.V.A. when this presentation was made to Professor Mitchell. The Professor was a Past-President and had rendered notable service to the Association. On behalf of the Council and all the members Mr. Hebeler expressed his very good wishes to Professor and Mrs. Mitchell in their retirement. Supporting speeches were made by Captain T. M. Mitchell and by Mr. George Tullis.

DR. TOM HARE

The following tributes were paid to the late Dr. Tom Hare at a meeting of the Council of the B.V.A., held in Edinburgh on April 10th.

The President, from the Chair, said: "Many tributes have appeared in the press to Tom Hare's many and varied qualities. It is with regard to his services as a member of Council that I shall wish to pay my tribute; indeed, this was the only capacity in which I knew him.

"Dr. Hare had the distinction of being the first veterinary student to be President of the Liverpool Debating Union; and his fluency and skill in the debates of our own Council were a great delight to those who enjoy hearing good English spoken really well. His sincerity was always obvious, and if one did not always entirely agree with his opinions, they were put forward in such a delightful manner that even those most hotly opposed to them could not but enjoy hearing him speak.

"His loyalty to the Chair was well known. On the day of the London meeting of Council last November, he telephoned the office to express his

apologies for not being present at that meeting, and spoke to me personally. His kindness, and the encouragement he gave me, will be something by which I personally shall long remember Tom Hare."

Mr. Sydney Jennings: "I would also like to pay tribute to Dr. Tom Hare. As the President has said, he was a staunch member of our Council. We remember how, in a jocular manner, we used to predict the length of Council meetings according to whether he was there or not; but we loved him, and now he has passed from all human contacts we miss him. We wish he were here to-day, because he represented a tradition of this Council and country, whereby a man is entitled to freedom of speech and demands tolerance of his own opinions. He often taught us there was another point of view to be considered. He never sat on the fence—he was always on the side of those whom he thought to be oppressed.

"Those who knew him intimately found him full of the milk of human kindness: I have never heard him speak badly of anyone."

Miss Olga Uvarov: "He also did a very great service to this profession in the way he represented us among his medical colleagues. I have been privileged to see him taking his place as President of the Harveian Society; and to have seen him thus, giving his Presidential address, is something I shall never forget.

"He had a wonderful sense of participation in the welfare of his old students, and that is a point which I think is very important to those of us who have qualified and have been his students. You could always approach him on any problem, personal or professional, he would always help, and then follow up by writing to you. In losing him we have indeed lost a very great servant of this profession."

MR. HERBERT SCOTT DUNN

Professor McCunn writes:—

Herbert Scott Dunn died at his home, Benfield House, Hangleton, near Hove, on the afternoon of Thursday, April 9th. A few weeks previously he had suffered from a rather severe attack of bronchitis. He recovered sufficiently to get about, but on April 4th, after attending a meeting of a show committee in Brighton, he had a setback and had to take to his bed again. No doubt he tested his strength too severely, but I could not imagine that one of his indomitable spirit could be restrained in bed if it were at all possible to get out.

Scott Dunn was a unique character. He was a good veterinary surgeon who loved his work and was prepared to give service at all hours of the day or night. In his prime Sundays, Saturdays, and weekdays were all the same to him if there was work to be done. He loved meeting people, and whatever the hour his clients welcomed him: they represented a complete cross section of society. On week-ends spent with him I have been in the homes of stage, screen, and radio celebrities, in the mansions of members of the peerage and great industrial magnates, on farms, and in humble cottages. The social status of the client did not influence him, and in all cases the patient was his first concern. He had a great fund of humour, and his wise, pithy, sometimes biting, remarks were taken always in the spirit in which they were given.

He kept up to date, and all the latest drugs were in his dispensary. I remember that he was using "Nembutal" before I even heard its name, and he dragged me out of an armchair one Sunday afternoon so that we could see if a cat, to which he had given the drug on the previous day, had recovered from its effects. His surgical theatre was equipped with a modern "oil pump operating table"; he was a pioneer in heat and light treatment and in the use of X-rays. He gave of his services freely to dog shows, horse shows, and charitable projects. His pocket was always open to those in need, too open, and he would go to any length to help a fellow practitioner. In his later years many veterinary surgeons set up in his area. This might have made him bitter, but several of them have told me that they received more kindness and help from "Old Scottie" than from any other man. He was a founder of the Sussex Veterinary Society and for many years a very active Fellow of the Central; his contributions to the discussions were sage and witty to a high degree. He served as President in both Societies and his control of the meetings, especially of long and boring speakers, was a joy to behold.

There is one characteristic of this unique man which must be recorded. It was his intense loyalty. He worked for the great Albert Wheatley, and then for many years for G. P. Male ("the Guv'nor") at Reading. To Scottie the "Guv'nor" had no fault and woe betide anyone who took his name in vain. Only a few weeks ago at Crufts show I did this purposely to see if the reaction was as strong as ever. It was and I was crushed. The memory of this loyal, witty, kind, and competent veterinary surgeon will endure in the hearts and minds of his professional colleagues and his clients.

DR. ARTHUR WALTON

Dr. Arthur Walton, the distinguished physiologist and pioneer in the field of artificial insemination of farm animals, died on April 6th at the age of 62.

In 1927 he obtained the degree of Doctor of Philosophy from the University of Cambridge and soon established himself as an authority on the subject of animal reproduction. His were some of the earliest experiments which proved that animal semen can be stored for long periods of time and then used successfully for artificial insemination.

Among recent recognitions was the award of the Medal for Outstanding Research in Agriculture, in 1957, from the Royal Agricultural Society of England.

UNIVERSITY NEWS

Cambridge

At a Congregation held on February 21st, 1959, the degree of Ph.D. was conferred on L. F. Taffs, M.R.C.V.S., of Downing College. The title of Dr. Taffs' thesis was "Immunological Reactions of the Host to the Nematode *Ascaris suum*."

ROYAL SOCIETY OF HEALTH CONGRESS

The Veterinary Hygiene Section of the Royal Society of Health Congress at Harrogate will be held on Wednesday, April 29th. The meeting commences at 10 a.m. in the Lounge Hall, Royal Bath.

The programme will include: Presidential address by Mr. W. Tweed, followed by a paper, "Bovine Tuberculosis; the End in Sight," by Mr. J. N. Ritchie, C.B. The discussion will be opened by Mr. G. N. Gould. A second paper, "The Slaughterhouses Act, 1958," will be read by Mr. P. B. Dingle, D.B.E., and the discussion will be opened by Mr. R. V. Blamire. Dr. J. C. Greatorex is again acting as recording secretary.

R.C.V.S. OBITUARY

We record with regret the death of the following member of the profession:—

McCORRY, Peter A., of Rosebank, Ballyconnell, Co. Cavan, Eire. Graduated at the Royal Veterinary College, London, July 17th, 1908. Died January 10th, 1959, aged 74 years.

PERSONAL

Mr. A. S. Bremner has been appointed Veterinary Officer and has taken up station at Lincoln.

Marriages

DAVIES—THOMAS.—On April 4th, 1959, at Bwlchygroes, Llandysul, D. Charles Davies, M.R.C.V.S., D.V.S.M., to Georgia Thomas, S.R.N.

A marriage has been arranged, and will take place quietly, between Dr. W. S. Gordon, C.B.E., M.R.C.V.S., F.R.S.E., and Mrs. Elizabeth Webster Hay, widow of Dr. David H. Hay.

Birth

KAY.—On March 14th, 1959, at Rotherham, to Mary (*née* Brown, L.D.S.), wife of Robert S. Kay, B.V.SC., M.R.C.V.S., a daughter.

COMING EVENTS

April

22nd (Wed.). Ordinary General Meeting of the Southern Counties Veterinary Society at the Polygon Hotel, Southampton, 7.30 p.m.

23rd (Thurs.). Meeting of the Essex Veterinary Society in the Senior Common Room of the Essex Institute of Agriculture, Writtle, Chelmsford, Essex, 7.30 p.m.

Meeting of the Clinical Club of the West of Scotland Division in the University Veterinary School, 83, Buccleuch Street, Glasgow, C.3, 7.30 p.m.

24th (Fri.). Meeting of the Mid-West Veterinary Association at the Berkeley Café, Clifton, Bristol, 2.30 p.m.

25th (Sat.). Meeting of the B.S.A.V.A. North West Region at the Stork Hotel, Liverpool.

Annual General Meeting of the Association of State Veterinary Officers in the Auditorium of the Wellcome Research Institute, 183-193, Euston Road, London, N.W.1, 4 p.m.

Meeting of the B.S.A.V.A. North-West Region in the Stork Hotel, Queen Square, Liverpool, 1, 8.15 p.m.

May

1st (Fri.). Reception and Dance of the Midland Counties Veterinary Association at the Mount Hotel, Tetterhall Wood, Wolverhampton, 9 p.m.

Reception and Dance of the Midland Counties Veterinary Association at the Mount Hotel, Tettenhall Wood, Wolverhampton, 9 p.m.

13th (Wed.). General Meeting of the Lancashire Veterinary Association at Booth's Café, 5, Fishergate, Preston, 2.30 p.m.

Spring Meeting of the Eastern Counties Veterinary Society at the Angel Hotel, Bury St. Edmunds.

15th (Fri.). Dance of the V.V.B.F. Ladies' Guild Eastern Counties Division at the Guildhall, Cambridge, 8 p.m.

August

30th to 5th September. 77th Annual Congress of the British Veterinary Association in Folkestone. (Official opening Monday, August 31st.)

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Dumfries. Kenmure, Dunscore (Apr. 3); Burrswark Farm, Ecclefechan, Lockerbie (Apr. 6); Ladyfield Farm, Cummertrees, Annan (Apr. 9).

Durham. Sayer Hill, Forest-in-Teesdale, Barnard Castle (Apr. 6).

Lancs. Harrison House Farm, Lea Town, Preston (Apr. 8).

Northants. Home Farm, Great Oakley, Corby (Apr. 6).

Fowl Pest

Essex. Benwell, Wick Crescent, Wickford; Cocks Farm, Kingsmoor Road, Great Parndon, Harlow (Apr. 6); Buena Vista, Brockhill, Wickford (Apr. 7); St. Johns Vicarage, Mawney Road, Romford (Apr. 8).

Herts. Box Hall, Bennington, Stevenage (Apr. 6); Lower Wilbury Farm, Stotfold Road, Letchworth (Apr. 8); The Cabin, Westmill Road, Ware; Church Hill, Bennington, Stevenage (Apr. 9).

Salop. Manor Farm, Woodseaves, Market Drayton (Apr. 6); Woodseaves Farm, Market Drayton (Apr. 9).

Sussex. 204, Harrow Lane, St. Leonards-on-Sea (Apr. 8).

Yorks. Peat Farm, Fulwood, Sheffield, 10 (Apr. 6).

Swine Fever

Devon. Tudorlands, Littlehempston, Totnes (Apr. 6); Bury Barton, Lapford, Crediton (Apr. 9).

Essex. Woodcote, Main Road, Bicknacre, Woodham Ferrers, Chelmsford (Apr. 6); West View, Oak Road, Crays Hill, Ramsden Crays, Billericay (Apr. 8).

Gloucs. Jubilee Road, Mitcheldean (Apr. 7); Whistlefield Farm, Bamfurlong, Cheltenham (Apr. 9).

Lancs. Mill House Farm, Mill Lane, Elswick, Preston (Apr. 6).

Notts. Glebe Farm, Langar (Apr. 8).

Oxford. Furlong Farm, Church Enstone, Chipping Norton (Apr. 7).

Somerset. Woodside Farm, Sparkford, Yeovil (Apr. 9).

Staffs. Greenhills Farm, Oaxen, Wolverhampton (Apr. 6).

Suffolk. Manor Farm, Swilland, Ipswich (Apr. 6).

Sussex. West Barnham Fruit Farm, Barnham, Bognor Regis (Apr. 6).

Wilts. Elmtree Farm, Rowdon Lane, Chippenham (Apr. 6); Darrells Farm, Elm Down, Ramsbury, Marlborough (Apr. 8).

Worcs. Lower Ashwood Farm, Wordsley, Stourbridge (Apr. 8).

PROFESSIONAL " CLOSED SHOP "

We think that readers will be interested in the following quotations from the correspondence columns of the *Daily Telegraph* and will applaud the uncommonly neat reply made by the wife of a member of the profession to complaints about professional " closed shops." The relevant letters are as follows:—

" Sir—Recent criticism of the closed shop system would be more convincing if it delivered a censure on the practice carried on by the professional classes. There is a far tighter 'closed shop' principle here than is found in the trade unions, where the doors are not closed to those who enter the trade. They do expect that a man, when admitted and working in their midst, should join the union.

" The professional classes, however, bar all entry to their ranks at the outset. The veterinary profession will not allow, for instance, an engineer to practise in their art, but do the engineers try to prevent any veterinary man entering theirs?

" The legal, medical, and many other professions have led the way for a very long time in closing their ranks completely to all outsiders. They use weapons other than strikes, and they know better how to use their powers than does the worker, whose only defence is the withdrawal of his labour.

Yours faithfully,
F. J. MURRAY.

Rochester, Kent."

" Sir—Mr. F. J. Murray declares that the professions exercise a much more stringent 'closed shop' than the trade unions, and cites as an example the refusal of the veterinary profession to allow 'an engineer to practise in their art.' There is no refusal, if he cares to undertake the long training and reach the high standard required.

" Restrictions, or more accurately regulations, regarding entry into the learned professions are designed to protect the customers. The trade unionist seeks only to protect himself, and therein lies the vital difference.

Yours faithfully,
(Mrs.) EVELYN B. WOOLDRIDGE.

Stanmore, Middlesex."

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

Mycobacterium johnei Infection of Calves

Sir,—Finding a source of infection-free animals for experiments on Johne's disease can be a very tedious task, consequently I was very interested in the article on *Mycobacterium johnei* infection in young calves by Cunningham and Gilmour in last week's RECORD. Recently my colleague Chandler (*Vet. Rec.* **71,** 147) published the results of a similar survey carried out in a different part of the country. The results of the two surveys are virtually the same and if we combine them we find that *M. johnei* was recovered from only 3 of approximately 600 calves sampled. This is in marked contrast to what would have been expected had a similar number of adult cattle been sampled in which case between 40 and 100 isolations of the organism would have been expected.

While agreeing that there is an obviously significant difference in the *recovery* rate from young calves compared with that from adult cattle I cannot agree with Cunningham and Gilmour that it necessarily follows that these calves have " *a low incidence of* M. johnei *infection*" and would therefore constitute a satisfactory source of experimental animals.

Cunningham and Gilmour mention two reasons why the true incidence might be higher than that stated, but both of these reasons would also apply to the various surveys made on adults. There is, however, a third reason which may be applicable only to calves, *viz.*: the slow rate of multiplication of the Johne's bacillus, the generation time of which is probably measured in days. If a calf becomes infected within a day or so of birth and is killed before it is one week old it seems unlikely that the original infecting dose would (a) be large enough or (b) have multiplied sufficiently to allow of its recovery by the techniques used. A further possible reason for the discrepancy is that the pharynx may be the portal of entry (Smith, 1958) and in neither of these surveys was this region examined.

The 3 cases of recovery of *M. johnei* mentioned in the above papers *may* represent the incidence of congenital infection in the samples. It would certainly be dangerous to assume that they represent a low infection rate.

Yours faithfully,
J. DEANS RANKIN.

Agricultural Research Council,
Field Station,
Compton,
Nr. Newbury, Berks.
April 13th, 1959.

Reference

SMITH, H. W. (1958). *J. Path. Bact.* **76.** 201.

First Edition of Markham's Masterpiece (1610)

Sir,—I think your readers will be interested to learn that one of the notable recent purchases by the Wellcome Historical Medical Library is a first issue of the first edition of Markham's Masterpiece (1610), hitherto known only from an imperfect copy in the British Museum. This work is the first standard veterinary manual in the English language, and was continually reprinted until 1883. The earliest edition in the W.H.M.L. before this purchase was the fifth edition of 1636. This first edition is a perfect copy and was formerly in the Christie library at Glyndebourne.

Your readers will no doubt recall that the Librarian of the W.H.M.L., Dr. F. N. L. Poynter, read a paper last December before the British Agricultural History Society on " The Place of Gervase

Markham in English Veterinary Literature"; you carried an account of the winter meeting of this Society in your issue of December 20th last.

Yours faithfully,

J. W. BARBER-LOMAX.

Burroughs Wellcome & Co.,
The Wellcome Building,
Euston Road,
London, N.W.1.
April 10th, 1959.

Histological Examination for Rabies

Sir,—The following sequence of events in two associated cases of rabies may be of interest to readers.

January 30th, 1959. A 9-month-old cat and an adult dog were thought to have had contact with a suspected rabid stray dog which had entered the owner's house and been shot. Both had evidence of saliva on them so were given intramuscular injections of chick embryo rabies vaccine as a precaution. The dog, which had been vaccinated on several previous occasions, was given the full dose of 3 c.c.; and the cat, which had not been vaccinated before, was given a dose of 1 c.c. Histological examination of the brain of the stray dog proved negative for rabies.

February 14th. The cat was normal until this date when it went off its food, appeared dull and sleepy, and developed a lameness in the right foreleg.

February 15th. Slight return of appetite; but during the day the cat, which was normally of a very affectionate disposition, became more so, persistently purring and following the owners about the house seeking attention. By the evening this had become much more marked and the cat had started biting the owners when it failed to get attention.

February 16th. The writer was telephoned by the owner for the first time since the date of the suspected contact and having heard the history advised the owner to bring the cat into the surgery so that it could be kept under observation. On being liberated from the basket the cat set up a high-pitched calling and moved about the room with a most unsteady and tremorous gait, so it was immediately put in the observation kennel.

During the course of the day the cat was quiet unless approached, when it seemed to go into a form of spasm accompanied by the same high-pitched calling. It did, however, manage to eat some meat and drink some water.

February 17th. Eighteen days after the injection of material into laboratory animals the stray dog proved positive for rabies.

Throughout the day the cat kept up a continual calling and was constantly moving round the kennel and jumping up at the door and walls. The lameness in the front leg was considerably more marked and the tremors were constant. No attempt to drink was made and a small piece of meat produced vomiting.

February 18th. The right foreleg was now completely paralysed and the tremors much more severe; by the evening the hind legs were also paralysed. In spite of the constant tremors it was noticed that in many respects the cat was mentally normal as abortive attempts at washing and sleeping were made but the tremors interfered. Sight at this stage was definitely defective; the cat appeared to be deaf to the sound of human voices but the sound of running water brought on very severe spasms. By the evening, with this constant activity, the cat was extremely weak and seemed unlikely to survive the night.

February 19th. Complete paralysis had now set in with accompanying paralysis of the vocal cords. The tremors continued throughout the day but neither the sound of voices nor running water produced any response; the animal appeared to be quite unconscious. During the course of the night the cat died.

February 20th. Histological examination of brain material proved negative for rabies.

March 9th. Eighteen days after the injection of material into laboratory animals, the cat was proved to have been strongly positive for rabies.

It must be concluded, therefore, that in all cases suspected of rabies, whether the animal dies naturally or is destroyed, the failure to demonstrate the presence of negri bodies on histological examination must always be regarded with extreme caution, particularly with reference to decisions on the advisability of prophylactic treatment of human contacts.

Yours faithfully,

M. R. DEXTER,
Veterinary Officer.

Department of Veterinary Services,
P.O. Box 49,
Cholo,
Nyasaland.
March 18th, 1959.

Vaccines against C.V.H.

Sir,—The recent introduction of canine virus hepatitis vaccines is, I am sure, welcomed by all small-animal practitioners. However, there appears to be some variation in the claims of the efficiency of the vaccines. One manufacturer claims permanent immunity after one injection, another only 12 months' immunity after 2 injections.

Perhaps the manufacturers concerned, or their agents, could explain this difference to us?

Yours faithfully,

123, King Street, ROBERT S. TOWNSON.
Maidenhead.
April 6th, 1959.

Simultaneous Inoculation against Distemper and C.V.H.

Sir,—At the recent B.S.A.V.A. Congress we were asked to comment on the rationale behind simultaneous inoculation against canine distemper and canine virus hepatitis. Workers in this country and the United States have shown that simultaneous vaccination can take place (Mansi, 1956; Burgher, Baker, Sarkar, Marshall & Gillespie, 1958; Cabasso, Stebbins & Avampato, 1958).

In these laboratories we have studied the development of neutralising antibody in 3 groups of 9-week-old puppies inoculated with egg-adapted living distemper virus, inactivated hepatitis virus, or both vaccines simultaneously.

The results may be summarised in the following table:—

Dog No.	Vaccine	Titre of serum neutralising antibody 28 days after vaccination completed to:— C.D.V.	C.H.V.
1E 18	Distemper	1:320	0
1E 19	"	1:40	0
1E 20	"	1:40	0
1J 46	"	1:160	0
1J 47	"	1:80	0
2A 82	Hepatitis	0	1:160
2A 83	"	0	1:160
1J 49	"	0	1:320
1K 56	Distemper + Hepatitis	1:320	1:640
1K 57	"	1:640	1:40
1K 58	"	1:1280	1:80
1K 59	"	1:320	1:40
2A 79	"	1:160	1:160

It will be seen that the two vaccines stimulate antibody development independently and show no interference with each other.

Yours faithfully,
D. G. HOWELL,
O. UVAROV,
R. E. ABLETT.

Glaxo Laboratories Ltd.,
Greenford,
Middlesex.
April 7th, 1959.

References

BURGHER, JOAN A., BAKER, J. A., SARKAR, S., MARSHALL, V., & GILLESPIE, J. A. (1958). *Cornell Vet.* **48.** 214.
CABASSO, V. J., STEBBINS, M. R., & AVAMPATO, J. M. (1958). *Proc. Soc. Exp. Biol. & Med.* **99.** 46.
MANSI, W. (1956) *J. comp. Path.* **66.** 136.

A Note on the Use of Suxmethonium Chloride (Succinyl Choline Chloride) for the Restraint of Zebra

Sir,—An intramuscular injection of succinyl choline chloride may be the only possible alternative to destruction in cases of horses which become unmanageable during air or surface transport.

Clinical reports on the results of the intramuscular injection of succinyl choline are rare. In view of this, one aspect of our work of catching wild animals such as zebra, to mark them for later identification with a view to establishing ecological facts such as migration cycles, may be of immediate value to practitioners.

A few days ago we made an experimental trial of succinyl choline for catching Grevy zebra (*Equus grevyi*). The drug was new to us, being used as a trial owing to unsuitable aspects in the drug we had been using previously. We had calculated that, when given intramuscularly, owing to its rapid breakdown in the body, several times the intravenous dose used in the horse would be necessary.

Our first zebra, a well grown stallion, was given 1.0 mg per estimated kg. bodyweight. He went down about 2 minutes after injection and rapidly died of respiratory or cardiac failure.

In our second trial (on a stallion of similar size) we gave 0.8 mg. per kg. estimated bodyweight. The animal went down in just over 2 minutes with noticeable absence of struggling and after remaining down for 58 minutes rose to his feet apparently completely normal. It has afterwards been decided that some defect in the syringe must have prevented this animal from obtaining more than part of his dose, as the calculated dose is one which subsequently proved easily fatal in other zebra of similar weight. It may be of interest to mention, however, that during the 2 subsequent days this animal was kept in a corral, no reaction was seen at the site of injection.

Owing to apparent success of our second injection we cut down the doses in our next 2 animals (both male) by only 20 per cent., and again by 20 per cent. Both died in spite of clearly adequate artificial respiration. The second of these animals appeared to have recovered to the extent of turning its ears and eyes to sounds, when the heart suddenly slowed and stopped.

Our next animal was given a dose of 0.1 mg. per kg. which only caused slight ataxia in 3½ minutes and no other effect. We were able to give a second injection an hour later of 0.2 per kg. and in this case obtained perfect control. The course of events was as follows:—

0′ 00″	Injection. Animal plunges on feeling needle, but soon settles down and trots around apparently unconcerned.
5′ 00″	Slight ataxia.
6′ 00″	Lies down, no struggling; apparently quite happy. Head up.
9′ 30″	Head and withers down. Respirations deep. 18 per min. slight difficulty. Mild attempt to rise on withdrawing syringe. Resp. 28 per min., deep.
12′ 30″	Head and withers raised.
13′ 30″	Mild attempt to rise, breathing normal; looking round; interested; auricular reflexes never absent.
22′ 00″	Rises to feet. No ataxia. Apparently feels quite normal.
26′ 00″	Observed to be eating.

It is noteworthy that in no case was there any struggling on going down or rising. The animals in question, all well grown males, gave no sign of fear or the impression of undergoing an unpleasant experience.

We are aware that our observations of doses from which recovery took place are limited to one animal, and we had no opportunity to determine the effective paralysing dose in this species by the intravenous route. It is possible that the Grevy zebra is relatively more susceptible to this drug than, for instance, the horse.

From these observations we are, however, able to stress:—

(a) The extraordinarily rapid action of succinyl choline given intramuscularly.

(b) The possibility that effective intravenous and intramuscular doses may not greatly differ.

Yours faithfully,
J. A. LOCK,
A. M. HARTHOORN.

Depts. of Medical Pharmacology and Veterinary Physiology,
Makerere College,
Kampala.
April 6th, 1959.